TRANSLATION OF PCT/EP2004/008398

ARRANGEMENT FOR FIXING AN ADD-ON PIECE, E.G., AN EXCAVATOR SHOVEL, TO A BOOM OF A SHOVEL OR TO A VEHICLE IN A REPLACEABLE MANNER

Description:

The invention relates to an arrangement for fixing an add-on piece, e.g., an excavator shovel, to a shovel boom or to a vehicle in a replaceable manner. According to the invention, two parallel holding bolts oriented parallel to and spaced apart from each are arranged on the add-on piece. These holding bolts can be gripped by grippers, which can be displaced in relation to each other and which are arranged on a holding element on the shovel boom or on the vehicle. The grippers comprise at least partially open insertion openings for the holding bolts. One gripper is connected to the holding element in a fixed manner and one gripper is held in a guide of the holding element in a linearly displaceable manner.

One arrangement, as it is known from WO 93/01366, can be used in all add-on pieces, such as, e.g., excavator shovels, excavator blades, snow removal blades, tools, etc. Relatively high forces, which must be absorbed by this arrangement, are generated in the region of the arrangement for replaceable attachment of the add-on piece. WO 93/01 366 does not address a special guide for the gripper and optimizing the force transfer between the boom or vehicle and the add-on piece. In contrast, US 4,881,867 shows a guide of a displaceable gripper, which receives forces perpendicular to the displacement direction.

In another known device for replaceable attachment of a tool-like add-on piece, on the front end of an excavator handle (EP-A-0625613), the insertion openings of two grippers are aligned offset by ca. 90° in relation to each other. After threading one gripper into a holding bolt, the entire arrangement is pivoted about this holding bolt until the other gripper with the insertion opening lying perpendicular thereto grips the other holding bolt. Through the use of a hydraulic displaceable locking element, now the insertion opening of the second gripper can be blocked. All of the forces act on the locking element.

Another known tool changing device (WO97/28314) for hydraulic excavators provides stationary and pivoting grippers. Here, a large torque, which increases even more especially during the excavation work, is generated on the pivoting gripper.

Furthermore, an arrangement for an excavator is known (WO88/02421), in which one of the grippers is configured in two parts and therefore is formed by a stationary abutment and by a displaceable locking member that can be adjusted via a hydraulic unit arranged laterally offset to the two grippers. The hydraulic unit, comprising a cylinder and piston, must be supported on both ends by bolts so that it can rotate, because this unit must realize a pivoting motion when the locking member is displaced.

Furthermore, a quick-change device for an excavator shovel to be attached to a shovel boom is known (EP-A-0058058), in which, on one side there is a gripper, which can be pressed onto a correspondingly shaped shoulder. On the other side, the boom has a hook-shaped part, which has an opening that faces in the direction towards a hydraulic drive and that has a beveled limiting surface on one side. A clamping shoe arranged on the piston of the hydraulic drive has a limiting surface beveled in the same direction, so that locking and bracing can be realized through the interaction of the two beveled limiting surfaces. Here, a moving suspension of the cylinder of the hydraulic drive is also absolutely necessary.

In another known coupling device (EP-A-0468771), two coupling pairs are always needed, of which one gripper element is held fixed and the other gripper element is displaceable by a hydraulic drive. Displaceable gripper elements allocated to the two coupling pairs are connected to each other by a connecting element in order to be able to activate them simultaneously by the hydraulic drive. Such a construction is complicated and is also barely able to handle the resulting forces due to the required long connecting brace.

In another known quick-change arrangement (US 5,465,513) of the type named above, a hydraulic unit consisting of a piston and cylinder is provided between a stationary and a displaceable gripper,

wherein this unit is typically connected to the grippers by pins. Therefore, force components acting in a wide array of directions are produced and furthermore, manufacture, assembly, and construction work are disadvantages for such a configuration.

An arrangement of the type named above is known from AT-B-410,333. Here, the grippers are displaced relative to each other by a hydraulic cylinder, wherein the axes of the holding bolts, the insertion openings of the gripper, and the hydraulic cylinder lie in one plane. Therefore, an optimal force transfer is achieved, without the hydraulic or pneumatic drive having to absorb high forces. Therefore, only small forces are to be applied in order to hold the displaceable gripper in its locked position.

The objective of the present invention is to produce an arrangement of the above-noted type more easily and above all with structurally simpler means, in order to be able to implement a purely mechanical lock and detachment between the add-on piece and the shovel boom or vehicle.

According to the invention, this objective is met in that spring elements acting in the closing direction of the gripper are associated with the linearly displaceable gripper. An insertion opening which is open in the direction of an imaginary plane through the axes of the holding bolts is provided on the fixed gripper, and an abutment which is oriented at least approximately at right angles to the imaginary plane, at a distance matching the distance between the holding bolts, is provided on the holding element as an insertion part for the second holding bolt. The displaceable gripper comprises a hook-shaped, freely projecting section for at least partially gripping the second holding bolt on the region opposite the abutment.

For such a configuration, in a simple way the add-on piece is locked with the holding element, so that after this locking, a rigid connection is guaranteed, without a load in the opening direction having been placed on the displaceable gripper. Thus, a low force is sufficient to hold the displaceable gripper in the closed position, wherein this force can be applied by a structurally simple spring element. Thus, a mechanical solution has been created, which exhibits an optimal

effect and causes a secure locking with low costs and can be maintained even for heavy loads during excavation work.

It is further proposed that the displaceable gripper is formed as an essentially T-shaped component, wherein one part engages in the guides of the holding element and the other part is configured approximately at right angles to the first part as a freely projecting, hook-shaped projection. Thus, only one part is necessary for the displaceable engagement in the guide and the hook-shaped section, which can partially grip one holding bolt.

There is a particular structural variant, such that a mounting element is connected rigidly to the displaceable gripper, which has means for attaching one end of the spring element. Thus, in a simple way a connection to the spring element can be created.

In this connection, it is advantageous when the displaceable gripper and the mounting element are screwed to each other. Therefore, a simple assembly or disassembly is possible and the displaceable gripper in itself is not a complicated part to be produced.

Just through the configuration of the linearly displaceable gripper and the arrangement of a spring element, an optimal action is to be realized in a simple way. Therefore, the spring element attaches on one side to the mounting element and on the other side to a fixed part of the holding element.

So that the spring element is especially protected even during construction work, it is proposed that the mounting element has a freely projecting flange, which covers the spring element in the closed position of the displaceable gripper up to the add-on piece.

In the scope of the invention, it is proposed that the spring element is formed by at least one helical spring. Thus, a very simple structure can be provided, so that hydraulic or pneumatic elements, which are expensive and susceptible to faults, are not necessary.

An advantageous arrangement provides that the spring element is formed by two helical springs oriented parallel to each other. Therefore, a correspondingly strong closing force can be generated and also a special safety is guaranteed if an element of the spring element were to fail.

When the add-on piece is attached, a simple contact can be possible under the application of the force of the excavator blade. So that the add-on piece can also be detached easily, it is further proposed that means for attaching an implement, e.g., a rod, for displacing the gripper are provided on the displaceable gripper and/or on the mounting element connected to this gripper. It is then opened through manual engagement of the displaceable gripper opposite the force of the spring element against the closing direction, so that the add-on piece can then be pivoted open.

A structurally simple solution is then achieved if there is a angle bracket on the free, outwards projecting end of the mounting element for attaching an implement. Then, a corresponding implement can be inserted easily behind this bracket and then by pivoting the tool, the displaceable gripper is shifted against the force of the spring element into the open position.

In another embodiment, an elongated hole formed on the free, outwards projecting end of the mounting element is provided as means for attaching an implement.

So that an optimal locking between the holding bolts and the grippers can take place, wherein no special forces are exerted on the spring element also in the closed position, on one hand it is proposed that the insertion opening of the fixed gripper is formed by a main part, which is adapted to the diameter of the holding bolt and which has a semicircular cross section, and optionally angled insertion surfaces adjacent to this main part.

On the other hand, a special configuration in the inlet region of the displaceable gripper is proposed, which is characterized in that the insertion opening on the fixed gripper is formed opposite an abutment extending at an acute angle to the imaginary plane through the center axes of the holding bolts.

This abutment transitions at the top end into a circular arc section and grips the other holding bolt as a support section.

In this connection, it is especially advantageous if the hook-shaped, freely projecting section of the displaceable gripper has an insertion opening, which is directed towards the abutment and which has a main part that is at least approximately semicircular in cross section and insertion surfaces adjacent to this main part on both sides. Therefore, the displaceable gripper is given the task of only stopping a holding bolt from pivoting about the axis of the other holding bolt. The holding in the plane of the holding bolt is realized by the insertion opening in the fixed gripper and by the abutment opposite the insertion opening of the fixed gripper.

It is further proposed that the free end region of the hook-shaped section opposite the insertion opening has a rounded closing surface and thus is formed with a tapering profile towards the insertion opening. Thus, a significant improvement is realized just in the coupling between the add-on piece and the excavator blade. Through this special configuration, there is the useful ability to press the displaceable gripper to the side during the mounting process of the add-on piece until the corresponding holding bolt can be engaged and the displaceable gripper can reach its closed position.

So that the displaceable gripper is always supported, for example, under the force of the spring element on one holding bolt, and thus a spring-loaded contact is always guaranteed, it is proposed that an opening, which is smaller than the diameter of a holding bolt, remains between the abutment and the insertion opening on the hook-shaped section of the displaceable gripper, so that a constant positive and frictional fit is given when the holding bolt has been inserted.

Additional features according to the invention and special advantages are explained in more detail in the following description with reference to the drawings. Shown are:

Figure 1 a front view of a holding element, which is mounted on an excavator blade or on a vehicle;

Figure 2 a section along the line II-II in Figure 1;

Figure 3 a section along the line III-III in Figure 1;

Figure 4 a perspective view of the holding element shown like an exploded view;

Figure 5 a side view of a part of an excavator blade with attached holding element and mounted add-on piece.

In an arrangement for replaceable attachment of an add-on piece 1, e.g., of an excavator shovel, to a shovel boom 2 - also called excavator blade - or to a different vehicle, for example, to a construction vehicle or to a vehicle for the forestry or agricultural industries, on the add-on piece there are two holding bolts 3 and 4, which are oriented parallel to and spaced apart from each other and which can be gripped by grippers 6 and 7 that are arranged on the boom 2 for a shovel on a holding element 5 and that are adjustable in relation to each other. The holding element 5 can also be designated as a mechanical quick-change device. The grippers 6 and 7 have at least partially open insertion openings 8 and 9 for the holding bolts 3 and 4. One gripper 6 is connected rigidly to the holding element 5 and one gripper 7 is held linearly displaceable in a guide 10 of the holding element 5. Spring elements 11 acting in the direction of the closed position of the gripper 7 are associated with the linearly displaceable gripper 7. An insertion opening open in the direction of an imaginary plane through the axes of the holding bolts 3 and 4 is provided on the fixed gripper 6, and an abutment 12 which is oriented at least approximately at right angles to the imaginary plane, at a distance matching the distance A between the holding bolts 3 and 4, is provided on the holding element 5 as an insertion part for the second holding bolt 4. The displaceable gripper 7 comprises a hook-shaped, freely projecting section 13 for at least partially gripping the second holding bolt 4 on the region opposite the abutment 12.

Through the measures according to the invention, a very wide array of necessary add-on pieces 1 can be dismounted and replaced quickly and in an uncomplicated manner. The add-on pieces 1 can then pivot about the support bolts 34 and 35 arranged on the holding element 5 by means of the hydraulic cylinders 33 arranged on the shovel boom 2, so that the excavation work can be performed.

The displaceable gripper 7 is formed as an essentially T-shaped component, wherein one part 14 engages in the guides 10 of the holding element 5 and the other part is configured as a freely

projecting, hook-shaped section 13 approximately at right angles to the first part.

A mounting element 15, which has means 16 for attaching to one end of the spring element 11, is connected rigidly to the displaceable gripper 7. The displaceable gripper 7 and the mounting element 15 are screwed to each other. The spring element 11 is advantageously suspended or mounted on one side on the mounting element 15 and on the other hand on a fixed part 17 of the holding element 5. For mechanical protection of the spring element 11, the mounting element 15 has a freely projecting flange 18, which covers the spring element 11 in the closed position of the displaceable gripper 7 up to the add-on piece 1. In Figure 2, a position is shown, in which the holding bolts 3 and 4 have not yet been engaged in the holding element 5. Therefore, the flange 18 contacts with its free end 19 directly onto the fixed part 17. In this shown position, an opening 20, which viewed all together is smaller than the diameter of a holding bolt 4, remains between the abutment 12 and the insertion opening 9 on the hook-shaped section 13 of the displaceable gripper 7, so that when the holding bolt 4 is inserted, a constant positive and frictional fit is given. In this position with the inserted holding bolt 4, the flange 18 then does not yet contact with its free end 19 the fixed part 17. Thus, when the holding bolt 4 has not been inserted, an imaginary distance B remains between the center point of the semicircular insertion opening 9 and the center point (center axis) of the holding bolt 4.

The spring element 11 is advantageously formed by at least one helical spring 21, 22. However, the spring element 11 is preferably formed by two helical springs 21, 22 oriented parallel to each other. In the scope of the invention, however, other configurations of spring elements 11 are also conceivable. Thus, any stressable, elastically expandable and restorable components can be used. Also, such spring elements or combinations of various types of spring elements can be used and thus a mechanically perfect and effective arrangement can be formed for the quick changing of add-on pieces.

Because the add-on piece 1 can be attached by the force of the shovel boom 2, the detaching is also simple. For this purpose, on the displaceable gripper 7 and/or on the mounting element 15 connected to this gripper there are means for attaching an implement, e.g., a rod, for displacing

the gripper 7. In the shown embodiment, there is a angle bracket 32 on the free, outwards projecting end of the mounting element 15 as means for attaching an implement. In the scope of the invention, however, it would also be conceivable to provide an elongated hole formed on the free, outwards projecting end of the mounting element 15 as means for attaching an implement.

One important construction feature is the arrangement and the configuration of the insertion openings 8 and 9 of the grippers 6 and 7. The insertion opening 8 of the fixed gripper 6 is formed by a main part 24, which is adapted to the diameter of the holding bolt 3 and which has a semicircular cross section, and optionally angled insertion surfaces 25 and 26 adjacent to this main part. An abutment 12 extending at an acute angle to the imaginary plane through the center axes of the holding bolts 3 and 4 lies opposite the insertion opening 8 on the fixed gripper 6. This abutment transitions at the top end into a circular arc section 27 and can grip the other holding bolt 4 as a support section.

The hook-shaped, freely projecting section 13 of the displaceable gripper 7 has an insertion opening 9, which is directed towards the abutment 12 and which has a main part 28 that is at least approximately semicircular in cross section and insertion surfaces 29 and 30 adjacent to this main part on both sides. The free end region of the hook-shaped section 13 opposite the insertion opening 9 has a rounded closing surface 31 and is thus formed with a tapering profile towards the insertion opening 9. Therefore, the section 13 and thus also the displaceable gripper 78 can be forced back into the open position by the contact with a holding bolt 4 until the holding bolt 4 is in its proper position in contact with the abutment 12 and at the height of the insertion opening 9. Then, the displaceable gripper 7 can also be drawn back into its closed position by the spring element.

All in all, the arrangement according to the invention is a simple structural shape with optimal action for a mechanical quick-change device. No hydraulic or pneumatic parts are necessary for the attaching and holding of an add-on piece.